VERIFICATION METHOD FOR DETERMINING AREAS WITHIN AN IMAGE CORRESPONDING TO MONETARY BANKNOTES

BACKGROUND OF THE INVENTION

[0001] 1. Field of the Invention

[0002] The present invention relates to image processing, more particularly, to a verification method for determining areas within an image corresponding to monetary banknotes.

[0003] 2. Description of the Prior Art

[0004] Improvements in graphics and image duplication systems, which can include scanners, digital color copiers, and printing machinery and apparatuses, has also contributed to the increase in illegal counterfeit reproduction of various items. Counterfeiters nowadays commonly attempt the reproduction of monetary banknotes, currencies, stocks, bonds, and other valuable items for personal gain and profit. The task of distinguishing and discerning between legitimate items and copied fakes becomes increasingly difficult as printing and reproduction improvements allow copiers to reproduce banknotes that are virtually identical to legitimate ones. Therefore, there is a need to be able to effectively and precisely discern and distinguish counterfeited banknotes from authentic ones.

[0005] Banknote detection systems today typically incorporate a scanner or scanning mechanism of sorts. This converts information from a sample banknote into a digital data format representation for image processing. Once converted into digital data, a series of tests and procedures can be performed in order to confirm the validity of the sample banknote. This may include the identification of key features, such as landmarks, holograms, colors, serial numbers and pigments.

[0006] An important aspect of counterfeit currency detection prior to identification of key features involves the verification of areas corresponding to the monetary banknote within the scanned image. Often times, the size of the image is greater than that of the banknote. The valid location of banknotes within the image is thus required so that relevant counterfeiting tests can be performed on the confirmed areas, and not on the background image. Additionally, knowing the areas corresponding to the banknote will allow determination of a coordinate system for referencing in further tests.

[0007] If the banknote is scanned while imposed on a complicated background, the difficulty associated with distinguishing the actual banknote location increases. Background noise and patterns may further complicate the detection process. This may introduce irregularities, and invalid background objects can be misinterpreted as a banknote location. Variations in the shift, rotation and alignment of banknotes within the image may also complicate identification processes as a set frame of reference cannot be initially implemented.

[0008] Without the proper verification of banknote locations within a scanned image, being separated from the background image, optimal conditions for accurate counterfeit currency detection cannot be met.

SUMMARY OF THE INVENTION

[0009] Therefore, one objective of the claimed invention is therefore to provide a verification method for determining areas within an image corresponding to monetary banknotes, to solve the above-mentioned problem.

[0010] According to an exemplary embodiment of the claimed invention, a verification method for determining areas within an image corresponding to monetary banknotes is disclosed. The method comprising: dividing the image into a plurality of verification sections; generating a banknote boundary map having border sections corresponding to a boundary of valid monetary banknotes within the image; generating a texture decision map from the image having texture sections, the texture sections each having texture values within a valid range according to a valid monetary banknote, wherein generating the texture decision map includes: dividing the image into a plurality of feature sections; generating a texture feature map having texture values for each feature section; including the border sections within the texture sections; selecting feature sections having texture values within a first texture value threshold range as potential texture sections; determining an average texture value for surrounding feature sections of each potential texture section; and further including potential texture sections having surrounding feature sections with the average texture value within a second texture value threshold range within the texture sections, determining a number of objects in the texture decision map by removing texture sections in the texture decision map that correspond to the border sections in the banknote boundary map; calculating a texture property value for each object according to a texture feature map having a texture feature value for each verification section; calculating a shape property value for each object; and further removing texture sections from the texture decision map corresponding to objects that do not have the texture property value within a first predetermined range and the shape property value within a second predetermined range.

[0011] These and other objectives of the present invention will no doubt become obvious to those of ordinary skill in the art after reading the following detailed description of the preferred embodiment that is illustrated in the various figures and drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] FIG. **1** illustrates an overview of the verification method for determining areas within an image corresponding to monetary banknotes.

[0013] FIG. **2** illustrates an exemplary embodiment of a scanned image divided into a plurality of verification sections.

[0014] FIG. **3** illustrates an embodiment of the plurality of verification sections configured in an overlapping manner.

[0015] FIG. **4** illustrates generation of the banknote boundary map.

[0016] FIG. **5** is an embodiment illustrating color histogram data.

[0017] FIG. **6** illustrates color histogram data being extracted for each image section.

[0018] FIG. **7** is an embodiment illustrating gray level feature map generation.

[0019] FIG. **8** is an embodiment illustrating banknote boundary map generation.

[0020] FIG. **9** illustrates removal of internal border sections from border sections of the banknote boundary map, and dilation of the perimeter border sections.

[0021] FIG. **10** illustrates the color binary decision map.